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INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY

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1. INTRODUCTION

1.1 Objectives of Investigation

The objectives of the investigation of the application of HCMM thermal data to snow hydrology (HCMM Investigation No. 036) are as follows:

(1) Determine practical utility of HCMM thermal IR data to establish distribution of snow cover and determine accuracy of temperature measurements.

   a. Determine accuracy of surface temperatures acquired through use of HCMM thermal IR measurements.

   b. Determine relative resolution utility between VHRR and HCMM for thermal IR measurements.

   c. Specifically delineate and quantify the problems involved with measuring snow temperature from space and relate them to present and planned earth observing satellite systems. This objective will take into consideration and utilize the capability of HCMM for day and night thermal measurements over appropriate sites and the satellite's eight-day repeat cycle.

(2) Determine if and how HCMM measurements can be factored in with Landsat data into an overall snow hydrology program related directly to snowmelt runoff prediction.

(3) Develop an approach to automated data processing of combined visible and thermal infrared satellite acquired data to provide information of interest and use to the snow hydrologist.

1.2 Anticipated Results

The primary anticipated result of the proposed investigation is the development of improved techniques for the mapping and analysis of snow-cover using spacecraft-acquired data. The results will provide an evaluation of the usefulness of high resolution thermal infrared data for snow mapping and for input to snowmelt prediction programs; and will provide a better understanding of the relationships between the measured temperature values and such factors as type of snow, snow depth, type of

terrain, and vegetation. The mapping and analysis techniques can then be applied to the automatic processing of data from future spacecraft systems, and will eventually enable snow survey, which is a vital part of water resources management, to be accomplished on a more cost-effective basis.

2. ACCOMPLISHMENTS DURING REPORTING PERIOD

During this reporting period, the work on the project was continued at a low level of effort awaiting the launch of the HCMM satellite, scheduled for late April.

A limited further analysis of the HCM data collected on a U-2 flight in the spring of 1977 over the Salt-Verde Watershed in Arizona was carried out. A more extensive analysis of this particular data has not been undertaken because of the problems incurred on the flight (see previous progress report). Nevertheless, the imagery data were examined in consultation with personnel of the USGS Water Resources Division in Phoenix. As a result, it was determined that the only useable data from the flight were on the strip from Flagstaff to south of Mormon Lake. Some snow can be detected in the Mormon Mountains, just west of the lake. Therefore, the computer tape was processed for a segment in that area. However, the initial processing indicates very little contrast in temperature, even though contrast is apparent in the imagery data; the tape has been processed again, and the output is being examined further.

A U-2 flight was made over the Sierra Nevada test site area in California in early February. The data have been received and the imagery has been examined. Because of a considerable amount of cloudiness, it is doubtful that the data from this flight will be useful.

After much delay due to adverse cloud conditions, another U-2 mission over the central Arizona test site area was flown on 15 March. On that day, the weather conditions were reported to be excellent, and it is understood that both daytime and nighttime HCM data were collected. Because of schedule problems, it was not possible to have an underflight by USGS personnel at the same time as the U-2 flight, as had been hoped; nevertheless, it is anticipated that this flight should provide the best HCM data of the three flights made so far.

The Principal Investigator attended the fourth HET meeting held at the end of January, at which a presentation was made describing the background and objectives of the investigation. As a result of a request by the HET Chairman, a written response was submitted following the meeting to provide information on the requirement for calibrated HCMM data using the Army's White Sands Satellite Calibration Facility; it was stressed in the response that the White Sands facility is essential to the success of the investigation.

Late in the reporting period, the Principal Investigator also attended the HCMM Science Review Meeting, held at NASA Headquarters. Viewgraph material was prepared for this meeting; copies of the material were provided to the Project Scientist.

3. PROBLEMS

No significant problems are anticipated at this time. Of course, because the objectives of the investigation are related to snow hydrology, a delay in the launch date of the satellite may reduce the amount of useful data that can be collected this spring. Since data are not anticipated from the satellite until early May, it is unlikely that sufficient snowpack will remain in the Arizona test site area. However, it still should be possible to collect data over the other test site areas, including the Sierra Nevada in California. If the launch date slips beyond early May, it may be necessary to wait until the next winter season to collect useful snow data.

4. PLANS FOR THE NEXT REPORTING PERIOD

During the next reporting period, the analysis of the U-2 HCM data will be continued. The data collected last spring will be analyzed further, and the data collected over the Arizona test site area this March will be analyzed following receipt of the tapes and accompanying imagery.

It is anticipated that the initial data from the satellite may be received before the end of the next reporting period.

5. TRAVEL

During the past reporting period, the Principal Investigator attended the fourth HET Meeting, held in Phoenix on 25-26 January. The Principal Investigator also attended the HCMM Science Review Meeting held at NASA Headquarters on 29 March.

6. PUBLICATIONS

No publications have resulted from this investigation.

7. SIGNIFICANT RESULTS

No significant results have been obtained through the second reporting period of the investigation.

8. FUNDS EXPENDED

Approximately 10 per cent of the available funds have been expended to date. It is anticipated that the remaining funds will be adequate to complete the project.